REMARKS

The Examiner is thanked for the clarity and conciseness of the Office Action and for the citation of the references which have been studied with interest and care.

Objection to Drawings

Form PTO 948 accompanying the Office Action indicated that the drawings filed on October 8, 1999 will require submission of new drawings to correct various informalities. Formal drawings were submitted on December 6, 1999.

The Invention

According to the present invention, a method and apparatus for fuel cell packaging are embodied in a receptacle that is uniquely designed to accommodate and provide fluidic interfaces for a stack of fuel cells secured within the receptacle. Direct contact between port interfaces of the receptacle and ports of the fuel cells is facilitated by providing a receptacle configured to receive an arrangement of the individual fuel cells in an overlapping, stair-stepping, helical pattern such that the each cell has access to individual orifices in the receptacle for reactant and coolant distribution. Significantly, reactants and coolant are equalized in a manifold frame that is part of the fuel cell receptacle and not an internally created manifold, and individual conduits are provided for both the delivery and removal of the reactants and coolant. The use of a single orifice for each reactant and coolant increases the pressure drop and improves the (o-ring) sealed individual fuel cell to fuel cell distribution within the stack. By employing a side-fed manifold, the pressure builds up in the manifold itself, then once the pressure has equalized, the flow is forced through the individual orifices that feed or cool each fuel cell.

Claim Rejections - 35 U.S.C. §§ 102, 103

Claims 1, 3 and 6 were rejected under 35 U.S.C. 102(b) as being anticipated by Maru (U.S. Pat. 4,444,851).

Maru discloses a fuel cell stack 1 and a containment vessel 51. The fuel cell stack 1 is formed to provide passages for process and cooling gases, including an internal manifolding system 31. The containment vessel 51 provides external manifolds 41, 42, 43 and 44.

In contrast with the present invention, Maru teaches a fuel cell stack that uses internally created common manifolds to supply reactants to the stack. In a common end-fed manifold as described by Maru, the pressure drop will vary along the length leading to varied distribution of the reactants and coolant throughout the stack.

Maru clearly fails to disclose or suggest positioning fuel cells within a fuel cell receptacle in a stack such that both the top and bottom sides of each of the fuel cells are in direct contact with the receptacle. Moreover, Maru fails to disclose or suggest a receptacle including a plurality of port interfaces, the receptacle being shaped to receive a stack of fuels cells with ports on opposing sides of the fuel cells such that the port interfaces directly contact each of the ports providing individual fluidic connections between each of the ports and the port interfaces that they respectively contact.

Claims 1-4, 6 and 7 were rejected under 35 U.S.C. 102(b) as being anticipated by Van Linden (U.S. Pat. 4,176,213).

Van Linden discloses a fuel cell battery unit 1 that contains one or more fuel cell blocks 8, 9 that are attached to an I-beam 2 having a narrow intermediate piece 3. Primary ducts 5a, 5b, 6a, 6b, 7a and 7b for the transport of fuel, oxidising agent and, if necessary, electrolyte are provided in or on the beam. Secondary ducts (pipes 10a, 10b, 11a, 11b, 13a, 13b, 14a, 14b, 15a and 15b) are provided between the primary ducts and the fuel cell blocks.

According to Van Linden, a number of problems have to be overcome in determining the dimensions of the connections between the beam and the blocks. Formulae for determining the dimensions are presented at column 2, line 51 - column 3, line 9 of the cited reference. "These formulae mean in practice that relatively long but not excessively thin lines between the beam and the fuel-cell blocks are to be preferred." [Van Linden, column 3, lines 10-12.]

In contrast with the present invention, the Van Linden approach uses common manifolds to supply reactants to or from the stack. In a common end-fed duct manifold as described by Van Linden, the pressure drop will vary along the length leading to varied distribution of the reactants and coolant throughout the stack.

Van Linden clearly fails to disclose or suggest positioning fuel cells within a fuel cell receptacle in a stack such that both the top and bottom sides of each of the fuel cells are in direct contact with the receptacle. Moreover, Van Linden fails to disclose or suggest a receptacle including a plurality of port interfaces, the receptacle being shaped to receive a stack of fuels cells with ports on opposing sides of the fuel cells such that the port interfaces directly contact each of the

ports providing individual fluidic connections between each of the ports and the port interfaces that they respectively contact.

Further with regard to claims 4 and 7, which recite fuel cells in a staggered configuration, Applicant respectively traverses the assertion that "Van Linden specifically discloses that the fuel cell stack may be staggered... ." [Office Action, paragraph 4.] What Van Linden discloses is staggering a row of *cell blocks* relative to the opposing row of cell blocks on the opposite side the thin intermediate piece, not staggering adjacent fuel cells in a single stack.

Claims 1, 2 and 4-8 were rejected under 35 U.S.C. 102(b) as being anticipated by Reichner (U.S. Pat. 4,876,163).

Reichner discloses arranging tubular solid oxide fuel cells in a circular or spiral fashion, or in a folding pattern within a cylindrically-shaped generator, to address the problem of large temperature gradients between center and periphery cells in conventionally designed solid oxide fuel cell generators. Reichner further discloses enhancing the uniformity of the temperature of the cells by increasing the flow rate, oxygen concentration, and/or temperature of the oxygen-containing gas that is sent to cells at the periphery of the generator over that sent to cells at the center of the generator.

Reichner clearly fails to disclose or suggest positioning the fuel cells within the fuel cell receptacle in a stack. Reichner also fails to disclose or suggest a receptacle including a plurality of port interfaces, the receptacle being shaped to receive a stack of fuels cells with ports on opposing sides of the fuel cells such that the port interfaces directly contact each of the ports providing individual fluidic connections between each of the ports and the port interfaces that they respectively contact.

Claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over either Van Linden as applied to claims 1, 4, 6 and 7 above, or Reichner as applied to claims 1, 2 and 4-8 above. Also, Official Notice was taken "that O-ring seals are well-known in the art of fuel cell manifold assemblies and [it] would have been obvious to the skilled artisan for reasons such as hermetically sealing the junction of a fuel cell port and manifold."

Particularly in view of the common manifold teachings (and thus lack of need for individual port interface sealing) of the cited references, Applicant respectfully traverses the above assertion and requests that the Examiner cite a reference in support of the stated position.

Withdrawal of these rejections is respectfully requested in view of the amendments to the claims and for the reasons discussed above.

CONCLUDING REMARKS

Applicant submits that the application is in condition for allowance. Concurrence by the Examiner and early passage of the application to issue are respectfully requested.

Any additional fees which are required in connection with this communication and which are not specifically provided for herewith are authorized to be charged to deposit account no. 01-1125. Any overpayments are also authorized to be credited to this account.

Respectfully submitted,

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Version with markings to show changes made

In the Claims

1. (Amended) A method for fuel cell packaging comprising the steps of:

providing a fuel cell receptacle with a plurality of manifolds;

providing a plurality of fuel cells, the fuel cells including top and bottom sides and ports; and

positioning the fuel cells within the fuel cell receptacle in a stack such that both the top and bottom sides of each of the fuel cells [is] are in direct contact with the receptacle and each of the ports is interfaced with one of the manifolds.

6. (Amended) An apparatus for fuel cell packaging comprising:

a receptacle including a plurality of port interfaces, the receptacle being shaped to receive a stack of fuels cells with ports on opposing sides of the fuel cells such that the port interfaces directly contact each of the ports providing individual fluidic connections between [the fuel cells and the receptacle] each of the ports and the port interfaces that they respectively contact.